

## 8. A\_Eight - Linked

**Program Name:** A\_Eight.java

**Input File:** a\_eight.dat

Wikipedia articles often have links to other Wikipedia articles for the objects in the article that already have Wikipedia articles. We can use this direct linking to deduce how related two Wikipedia articles could be. To say that two articles, **a** and **b** are **related** means to say that *there exists a series of links you could click that could get you to the same article c starting from article a and article b*. Furthermore, the *strength of this relationship is determined by the smallest number of cumulative clicks* it takes to get from **a** to this mutually shared article, plus the number of clicks it took from **b**.

More concretely, imagine we had these Wikipedia articles, where the @ sign indicates a link from one article to another, and before the : represents the title of the article.

```
black_lab: A dog_breed@ that has black@ fur.
Jack_Russell: A hyper dog_breed@ that is often used to assist when hunting.
black: A color.
dog_breed: A phenotype of a dog@.
cat: A small mammal@ that the internet loves.
dog: A larger mammal@ that is a common household pet.
mammal: An animal@ with fur and births its young.
animal: A living organism that eats organic matter.
carrot: A yummy orange plant.
```

In this example, **black\_lab** and **Jack\_Russell** articles are related because they both link to the **dog\_breed** article with one click from **black\_lab** and one click from **Jack\_Russell**, so 2 cumulative clicks apart. In a similar situation are **cat** and **dog** related, both linking to **mammal** with one click again making 2 cumulative clicks between. **black\_lab** and **cat** are related because they both link to **mammal**, 3 clicks from **black\_lab** (once on **dog\_breed**, once on **dog**, then to **mammal**) and then one click from **cat**, so 4 cumulative clicks.

There is a notion of an article being linked to itself which implies that **black\_lab** is related to **dog\_breed** by 1 cumulative click (1 click from **black\_lab** and 0 clicks from **dog\_breed**). Furthermore, this means that **Jack\_Russell** is related to **animal** by 4 cumulative clicks (4 clicks - **Jack\_Russell** to **dog\_breed** to **dog** to **mammal** to **animal** + 0 clicks from **animal**).

Lastly, carrot and cat are not related because there are no links that can be clicked starting from these two articles to end up at the same article (because carrot is connected to nothing and nothing is connected to carrot).

Of the article pairs we just analyzed, **black\_lab** <=> **dog\_breed** is the strongest relationship because it has the fewest cumulative clicks. **carrot** <=> **cat** is the weakest because it has no relationship at all.

Now, using these definitions of related and cumulative clicks, given a list of article name pairs, put them in order from strongest relationship to weakest relationship.

**Input:** The first line will have an initial integer N indicating the N data sets to follow. In each data set the first line will contain an integer indicating the number of Wikipedia articles in this data set. Each article will take up one line, starting with a single string as its title, followed by a colon, followed by a brief article. All words in the article description ending with @ are considered linked to another article as denoted by the title. The @ only designates a link.

For example, **dog\_breed@** appearing in a sentence means that there exists an article with the title, **dog\_breed**, as you can see in the sample data below. The two strings for each article listing include the title and then a brief description, separated by ": ". The description will have zero or more references as described above. For instance, the first data listing below has two references, **dog\_breed@** and **black@**. The listing for **black** has no references at all.

After the listing of the articles will be another integer M indicating the M article pairs to be analyzed. Each article pair will have two strings with the titles of the two articles to be analyzed.

**Output:** A sorted list of the M article pairs, ordered from strongest relationship (least link count) to weakest relationship in the given configuration. If more than one pair have the same strength relationship, order them alphabetically. Output a blank line between each output set.

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### (A\_Eight – cont)

**Assumptions:** All links will exist in the data set. All article sets will have at least 2 articles. In an article pair, the two articles will be different. All article titles will be unique. All articles will have a title and content, with zero or more links to other articles.

#### Sample Input

```
2
9
black_lab: A dog_breed@ that has black@ fur.
Jack_Russell: A hyper dog_breed@ that is often used to assist when hunting.
black: A color.
dog_breed: A phenotype of a dog@.
cat: A small mammal@ that the internet loves.
dog: A larger mammal@ that is a common household pet.
mammal: An animal@ with fur and births its young.
animal: A living organism that eats organic matter.
carrot: A yummy orange plant.
6
black_lab Jack_Russell
cat dog
black_lab cat
black_lab dog_breed
Jack_Russell animal
carrot cat
10
a: b@
b: c@
c: d@
d: e@
e: f@
f: g@
g: h@
h: i@
i: j@
j: nothing
5
a b
a c
a d
a j
i j
```

#### Sample output:

```
black_lab dog_breed
black_lab Jack_Russell
cat dog
Jack_Russell animal
black_lab cat
carrot cat

a b
i j
a c
a d
a j
```